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SWARMING OF ANTS ON WESTERN UNITED STATES MOUNTAIN SUMMITS

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In July, 1951, surprising numbers of insects were noted at the top of an 8,000 foot mountain near Missoula, Montana. During the following year, many personal conversations about summit insects were held with men who had manned U.S. Forest Service fire lookout stations at various times in the past. These conversations revealed that gatherings of large numbers of winged ants on mountain and ridge tops were of fairly common occurrence in western Montana and northern Idaho and actually constituted a regular and considerable nuisance at some lookout points.

A search through the literature on ants for information on mountain top swarming yielded only a few observations from North America, of unusually high altitude distribution of winged individuals belonging to certain species, although some European records of ant swarming and mating activity on hill and mountain tops were found. It was felt that such an apparently widespread phenomenon should be further investigated. A program was initiated to try and secure additional information and observations on summit swarming of flying ants from Forest Service personnel located on the network of mountain top lookout stations throughout the western United States, and also to study the phenomenon locally, in conjunction with a general investigation of insect activity on one nearby mountain summit.

A single data sheet which could be readily filled out was prepared and the request made, through Forest Supervisors of the various National Forests in the western United States, that copies be placed with as many fire lookout observers as possible. This form was accompanied by an explanatory note describing some aspects of swarming behavior in ants and explaining the study program. The information supplied through these forms for the summer of 1952 as well as some data from previous years, based upon the memory or records of various individuals, was sum-

* This study was accomplished while the writer was on the staff of Montana State University.

marized and analyzed. About 30 persons who had observed summit ant swarms themselves were personally interviewed.

Summit swarming of ants was studied locally on Squaw Peak, altitude 7,996 feet, about 25 miles northwest of Missoula, Montana. This peak is rather isolated and has a fairly well defined summit below which there are extensive slide rock areas with patches of soil here and there supporting trees and alpine vegetation characteristic of the region. Nine visits were made to this peak during the period from late June to early September, 1952. Winged ants were directly taken and observed on July 28, 29, August 3, 8, 9 and September 2 and were collected at various times from pans of oil-covered water which were set out on and near the summit on June 28 and left until August 26 or September 2. These pans were of two sizes, 12x19x2 inches and 16x25x3½ inches and one of each size was placed at each of three stations whose relationship to each other is as follows: station A, summit, altitude 7,996 feet; station B, 163 feet from A, altitude 7,972 feet; station C, 173 feet from B, altitude 7,921 feet. The two lower stations were located at 290° with respect to the highest station. Small patches of soil and vegetation occurred at station A, but substrate at stations B and C consisted entirely of large lichen-covered rocks. Insects from the two pans at station C were kept together as were those from station B pans. The small pan (station A₁) at the summit was located on a four and one half foot cairn while the large pan (station A₂) rested on the adjacent summit surface. After these two pans were found to differ greatly in the number of ants trapped all insects from them were kept separately. On days when direct observations were made the estimated abundance, distribution on and around the summit, mating activity, and general behavior of winged ants were frequently noted. Altogether about 39 hours were spent in actual study and observation of general insect activity on and near the summit at times when winged ants were present.

Condensed and summarized data from summit lookout stations are presented in Figure 1¹ and in Table 1².

It should be recorded that many of the lookout station observers supplemented the information on their data sheets with more or

¹ Base map supplied through courtesy of McKnight and McKnight Publishing Co., Bloomington, Illinois.

² It is regretted that the help of the large number of fire lookout observers and District Rangers of the U. S. Forest Service who supplied information used in this study cannot be individually acknowledged here.

less detailed accounts of the ant swarming seen. These accounts agree with the descriptions of most persons who were personally interviewed and with the observations of the writer on Squaw Peak in consistently indicating 1) the location of swarms to be tops of mountains or ridges and 2) a definite restriction of the swarms to a rather small area at the actual summits, usually the highest object or objects there such as roof, windows and external stove pipe of the cabin, and in a few cases the tops of trees immediately

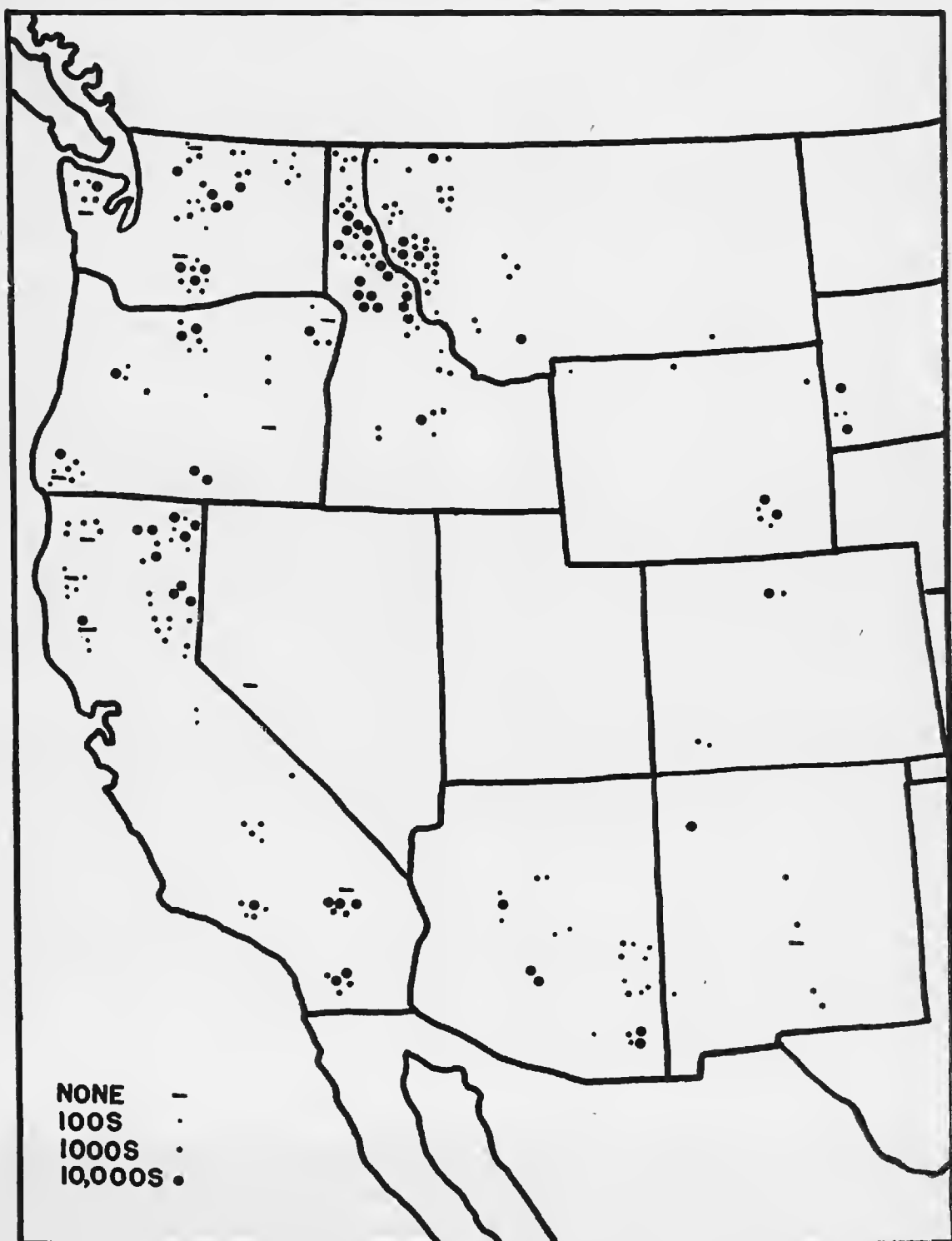


Fig. 1 Map showing distribution of reports of summit ant swarming.

adjacent to the summit as well. Frequently, when cabins were elevated on towers (which ranged up to 90 feet in height) swarms would be present by or on the cabins but not on the surface of the ground below.

TABLE I. CONDENSED AND SUMMARIZED INFORMATION FROM LOOKOUT STATION OBSERVERS

	<i>Number of Reports</i>		<i>Number of Reports</i>
Total	256	Altitude—all swarms of ants	
Size swarms (maximum num- bers reported from any area)		0 - 2,000 ft.	0
100s	69	2,000 - 4,000 ft.	21
1000s	111	4,000 - 6,000 ft.	73
10,000s	65	6,000 - 8,000 ft.	89
Mating of ants observed . . .	163	8,000 - 10,000 ft.	43
Shedding of wings observed . .	36	over 10,000 ft.	5
Maximum numbers ants on relatively warm calm days (wind less than 3 m.p.h.) .	118	Altitude—swarms of tens of thousands of ants	
Location of swarms at actual summit or top of ridges and mountains	240	2,000 - 4,000 ft.	6
Time of day at which swarms were reported to occur		4,000 - 6,000 ft.	23
7 - 10 A.M.	132	6,000 - 8,000 ft.	18
10 - 12 A.M.	164	8,000 - 10,000 ft.	8
12 - 2 P.M.	102	over 10,000 ft.	2
2 - 4 P.M.	72	Time of year at which swarming was noted	
4 - 6 P.M.	41	May	2
		June	30
		July , , , , , , , , , ,	198
		August	143
		September	40

Some degree of close observation is necessary in order to observe mating activity in swarms, and it was consistently noted on Squaw Peak at times of even light swarming. It is therefore felt that this activity is probably quite a consistent feature of summit swarming.

Shedding of wings was reported relatively few times. This might be due to the inconspicuous nature of the process or to the tendency of dealate females to seek shelter and thus be overlooked. However, no wing shedding was noted on Squaw Peak. Also, many observers described such large invasions of lookout cabins by the winged ants that they died in great numbers there, while at the same time stating that no shedding of wings was seen. Seevral persons interviewed stated that they had not noticed loss of wings and felt fairly certain that, because of the large numbers of winged ants present, they would have observed this had it been widespread.

Several collections of winged ants which occurred in summit swarms were sent in with the data forms. The ants represented and the number of samples in which each was found are as follows:³

<i>Formica sanguinea subnuda</i> Em.	24
<i>Formica</i> sp. (<i>microgyna</i> group)	1
<i>Formica</i> sp. (<i>fusca</i> group)	1
<i>Formica</i> sp. (<i>sanguinea</i> group)	1
<i>Formica</i> sp.	9
<i>Leptothorax canadensis</i> Prov.	9
<i>Leptothorax</i> sp.	2
<i>Myrmica aldrichi</i> (Whlr.)	2
<i>Myrmica lobicornis fracticornis</i> Em.	1
<i>Myrmica</i> (<i>Myrmica</i>) sp.	10

On the days when the writer observed the flying ant activity on Squaw Peak there was no doubt about the preference of the ants for the actual summit and, in the case of *Formica sanguinea subnuda*, for the two cairns on the summit (one eight feet and the other four and a half feet high). These ants were observed on July 29, August 3 and 9 to congregate in numbers (up to several hundred) on the upper rocks of the cairns, where they would crawl about actively and where mating took place. There always appeared to be many more males than females, a difference which showed up in most samples of this species which were set in by lookout observers. Counts made of samples of pan collected specimens gave the following ratios of males to females: 377 to 33, August 3; 377 to 16, August 9; 377 to 15, August 26.

Leptothorax canadensis, noted in hundreds on July 29, appeared to form loose flying groups to the leeward of the smaller cairn and only scattered individuals were seen elsewhere at that time. Data from the oil-water pans, given in Table II, show clearly that for both of these ants preference for the summit itself, and in the case of *F. sanguinea subnuba* the cairns specifically, exists. Differences in relative numbers of *L. canadensis* taken by large and small summit pans suggest some shifting of specific swarming site of this species about the summit. No aggregations of either species were seen away from the actual top of the peak although surrounding lower areas were frequently visited in order to determine swarm distribution.

Maximum numbers of ants were noted on relatively warm calm days. At these times the ants could be seen flying about at

³ All specimens were identified by M. R. Smith, U S National Museum.

the summit without being apparently influenced by air currents. At other times the ants seemed to have difficulty reaching and maintaining themselves on the cairns against the force of the wind. There is no doubt about the presence of eddies of air currents around the summit. At times, for example, southwesterly winds of eight to eleven miles per hour were measured there, while 20 to 50 feet down on the east side (10 to 50 feet in vertical elevation) velocities were close to zero. However, ants were never seen to swarm at such points.

TABLE II. ANTS COLLECTED BY OIL-WATER PANS ON AND NEAR SUMMIT SQUAW PEAK

Date of Collection ⁴		Station A ₁ Cairn	Station A ₂ Summit Surface	Station B	Station C
July 3	large ₅	109	(ants from	0	0
	small ₆	5	Station A ₁ and A ₂ combined)	0	0
July 15 ₇	large	522	not noted	0 ⁸	0 ⁸
	small	not noted	not noted	not noted	not noted
July 29	large	1418	400	5	5
	small	2285	3477	34	3
August 3	large	7922	265	26	8
	small	10244	3468	963	211
August 9	large	2701	238	9	6
	small	2511	3340	342	125
August 26 ₇	large	2090	268	14	4
	small	695	5310	552	187
September 2	large	8	not used	not used	not used
	small	13			

There are limitations to the use and interpretation of the information secured from fire lookout observers. Much of it was furnished by persons lacking technical training in biology and may be incomplete and even incorrect. Frequently only part of the information requested was given. Many of the lookout stations from which reports were received were manned only during certain periods of the summer, depending on area fire danger ratings, and

⁴ Pans set out June 28.

⁵ Mostly *Formica sanguinea subnuda* Em.

⁶ Mostly *Leptothorax canadensis* Prov.

⁷ Pans all dry on these dates.

⁸ Small pans only were checked.

thus do not include all instances of swarming which might have occurred. However, many observations had undoubtedly been carefully made and the data as a whole probably provide a reasonably good picture of many aspects of mountain summit ant swarming in the areas represented.

In trying to determine the causes of summit abundance of winged ants it is necessary to carefully consider the possible effects of wind on these ants. Complex air currents are a characteristic feature of mountainous regions. The topography influences and modifies large air mass movements in one direction and heating and cooling of the varied land surfaces, due to gain and loss by radiation during the day and night, respectively, produce varied local air movements. Fire control studies in the northern Rocky Mountain region by the U. S. Forest Service (Barrows, 1951) have shown that, as a general rule, upslope winds commence around 9:00 A.M. and continue until late afternoon when, after a short transition period, downslope winds occur. It is logical to assume that updraft air currents play a role in mountain top ant swarming. It is known that air currents can transport ants as well as other insects to considerable distances above the surface of the earth even under relatively mild weather conditions (Glick, 1939). In many ant species the reproductive forms leave different nests within an area at much the same time so that some temporary abundance of winged ants may be noted in almost any locality. (Forel, 1875, 1930; Emery, 1891; Wheeler, 1910). If ants emerge at lower elevations during the day any updraft currents would tend to carry them upwards. Winged ants are not considered to be strong fliers and almost any air movement in a particular direction might be expected to affect their distribution. Once ant reproductives were present in numbers on a summit, one would expect their mating activity to proceed as it would below.

It is interesting to note that in 118 of the reports from lookout stations and also at Squaw Peak, maximum numbers of ants were observed on warm calm days, if winds of three miles per hour and less are included in the calm category. Many ant species tend to swarm on such days at lower elevations. It is recognized that thermal updrafts are probably more clearly defined and therefore relatively more important as transporting agents on these warm calm days than at other times where more general air movements may play the dominant role.

Continuous measurements of air currents around a peak coincident with summit abundance of winged ants have not been made. The actual extent to which updrafts of various velocities might tend to carry ants of different sizes and flight powers likewise is not known although there is evidence, in abnormally high distribution of scattered ant reproductives, that air currents can transport ants upwards for considerable distances. Wheeler (1917a, 1917b) suggested that in mountainous regions winged ants were frequently carried above the normal species range by air currents and that annual loss of such individuals in terms of potential colony establishment might cause a considerable drain on certain species.

It is not yet possible to completely evaluate the role of updraft air currents as they may relate to summit ant swarming. However, there are several indications, based both on the writer's study on Squaw Peak, and on the data secured by others, that the ant swarms observed cannot be accounted for by air currents alone.

Probably the main difficulty in explaining summit swarming entirely on the basis of air currents is the apparent localization of ant swarms, of all sizes, at the actual tops of mountains and ridges and frequently within small areas on the summits. The Squaw Peak pan collection data show a very clear preference for the actual summit. Moreover, concentrations within a small area were repeatedly described by the lookout observers. There were far more opportunities for these observers to notice the ant swarms at summits than at lower elevations due to the fact that almost all lookout stations are located on the highest points of mountains or ridges. However, it was specifically reported by several persons that areas below the summits were visited during periods of swarming, and it can be assumed that there were many more observations made away from the highest points during such times in view of the following points: 1) swarming was frequently reported to be of several days duration, 2) leave and activities such as trail maintenance and transportation of water, for example, require that observers be away from the summit at times. Actually not a single person reported simultaneous swarming of ants at lower elevations and at summits.

Lookout stations from which "tens of thousands" of ants were reported ranged from 2,600 feet to 11,030 feet in altitude and included bare rocky peaks, where thermal air currents might be expected to be fairly strong, and grassy or brush and forest covered

ridges and hills, where thermals are certainly not as well developed. It might be noted that in all but a few cases reported by fire lookout observers only one or two kinds of ants were seen to swarm at any one summit.

Forel (1875, 1930) reported that swarms of *Myrmica rubra*, and of other species presumably, at times would form over standing men, roofs of houses, tall trees, church steeples, hill summits and even mountain tops and he recorded some summit mating activity for several species of ants.

It is hard to believe that air currents alone would produce such large localized concentrations of ants and at sites such as some of the points mentioned by Forel, or reported by lookout observers, or the cairns on Squaw Peak. One would expect wind or updraft carried insects to be scattered along the approaches to distinct peaks and throughout the length of ridges, since there is certainly some eddying of air currents below or near the highest point in either case. As a matter of fact one could also expect that updraft currents strong enough to be a major factor in carrying insects would tend to transport them on up above and away from the ridgetops or peaks. It is interesting to note in this respect that several other types of insects tend to be more abundant on mountain peaks and summits than below such areas (Chapman, 1954).

In summing up the consideration of air currents as the cause of summit abundance of winged ants it would seem that although such currents may play a role, a definite preference for the summits of ridges and mountains as swarming sites is shown by some ant species.

It is hoped that future work may provide more specific information on distribution of various summit swarming species, on the fate of winged ants after swarming, including the extent of wing shedding by females, on the duration of swarming for various species, distances through which summit ants may travel and on a number of other phases of this phenomenon which are not well known at present.

SUMMARY

Information and observations on the swarming of winged ants on mountain summits were secured from persons stationed at summit fire lookout stations throughout mountainous regions of the western United States during the 1952 summer season. Some records from years prior to 1952 were also obtained. This data was

recorded for the most part on a form which provided for systematic recording of desired information, and is summarized, analyzed and discussed in this report. Studies of mountain top ant swarming were also made by the writer on an 8,000 foot mountain near Missoula, Montana. Insects were collected and observations made at intervals during the summer of 1952 and the resulting data presented and discussed. It is felt that the following conclusions are justified:

1. Swarming of winged ants of certain species at the very summits of peaks and ridges is a definite and fairly widespread phenomenon in many of the mountainous regions of the western United States.

2. Although it is not possible at present to accurately determine the role of updraft air currents in producing such swarms it is unlikely that updrafts are the only casual factor.

3. An instinctive tendency to seek such points as swarming sites is probably present in some ant species.

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